THE RELATION OF TEMPERATURE TO CONTINUOUS REPRODUCTION IN THE PULMONATE SNAIL, PHYSA GYRINA SAY

BY DR. H. P. KJERSCHOW AGERSBORG
Atlantic University, Virginia Beach, Va.

Waste water from a corn products manufacturing plant at Decatur, Illinois, having a temperature from 28° to 35° C., provided continuously all the year a highly favorable medium for the fresh-water pulmonate, *Physa gyrina* Say. The temperature was practically constant during all ordinary workdays, including Sundays, for the entire year. In winter, when the temperature of the air was —10° C., that of the waste water ditch was still between 28° and 35° C.

The constant, high temperature of the waste water, with a certain amount of organic matter in solution, furthered the growth of fission fungi (*Sphaerotilus natans, Clonothrix, Beggiatoa rustica,* and their allies) ; these bacteria developed in enormous masses in the ditch, forming a black and putrescent sludge bed over a foot in depth. On the top of the sludge bed, and around the edges of the stream was a continuous mat of *Sphaerotilus* and related species, mixed with the slime algae, *Oscillatoria prolifica* and *O. limosa.* Upon this flora, *Physa* sustained itself. It grew and reproduced, even in the middle of winter.

In fact, this mollusc occurred in countless numbers, in solid masses covering the banks and bottom of the entire ditch for nearly a mile. It occurred as far up in the ditch to within the range of 33° C. (the temperature decreased farther and farther down the ditch).

Masses of nidosomes were deposited on the back of individual snails, on twigs projecting over the water, slightly touching it, on pebbles and stones along the sides of the stream—on every solid particle of the substrate. These situations provided more or less permanent positions for the nidosomes during the embryonic development. The top of the sludge bed was not satisfactory for this purpose. Nidosomes deposited on the back of individual snails, thereby being carried about from place to place during the embryonic development, evidently had been lodged in the most suitable situation.

I found only one embryo in each egg capsule. Many capsules were without any eggs.

Occasionally, when the work at the manufacturing plant was shut down, and the snail was subjected to the regular season's temperature, there was a great mortality amongst the snail population. Some snails buried in the surface layer of the sludge bed, which, owing to decomposition going on there, was of a higher temperature than the cold lake water. When the plant resumed operation and warm water had been flowing down the ditch for a few days, the snails occurred again seemingly as abundantly as before the cold water bath.

The shell of this snail was so thin and brittle that it was difficult to handle the shell without breaking it. This condition of the shell was probably due to the nature of the food upon which the snail was living; the amount of calcium in the water was about the same as that found in Lake Michigan, *e.g.*, between 27.9 and 33.0 in parts per million.

A complete chemical analysis of the water from typical snail beds, taken on the 5 and the 13 of February, 1929, snail beds, taken on the 5th and the 13th of February, 1929, show the water contained the following:[1]

	February 5, 1929	February 13, 1929
Turbidity	40.	5.
Sediment	Gray shreds (S. natans)	Gray shreds (S. natans)
Odor	Faint earthy	Faint earthy
Residue on evaporation	341.	342.
Loss on ignition	103.	92.
Suspended solids	26.	17.
Free ammonia	0,	0.
Organic nitrogen	1.36	0.76
Nitrites	0.024	0.075
Nitrates	0.3	0.9
Oxygen consumed	14.0	12.8
Chlorides	13.	10.
Alkalinity	165.	205.
Dissolved oxygen	5.7	5.5
Biological oxygen demand (five days)	15.1	15.4
Calcium	33.0	27.9

[1] I am indebted to Engineer W. J. Downer and the Chemist C. C. Larson of the State Department of Public Health, Division of Sanitary Engineering (Springfield, Illinois) for collecting the samples of water and making the chemical analyses, respectively.